REMARKS

Reconsideration of this application is respectfully requested in light of the above amendments and following remarks. Claims 1 – 7, 9 – 19 and 21 – 24 remain in the application; Claims 8 and 20 were previously canceled and claims 25 – 27 are cancelled in the present amendment.

I. Claims 4, 5, 9 and 16 were objected to because of the following informalities:
In claims 4, 9 and 16, "resister" should be corrected to -resistor--; and
In claim 5, "or dielectric material" should be deleted.

Applicant has amended claims 4, 5, 9 and 16 to remedy the above objections.

II. The disclosure was objected to because of the following informalities: The phrase, "a third resonator located on a third layer of dielectric material" should be deleted throughout the specification (including abstract).

Applicant has deleted the phrase "a third resonator located on a third layer of dielectric material" throughout the specification (including the abstract).

III. Claims 1-7, 9-19 and 21-27 were rejected under 35 U.S.C. 103(a) as being unpatentable over Peters (US '259) in view of Liang et al. (US 6,492,883) and Ammar et al. (US '404). Applicant begins with claim 1, which provides:

1. (Previously Amended) A voltage-controlled tunable multilayer filter comprising:

a first resonator on a first layer of low-temperature-co fired-ceramic (LTCC);

a second resonator coupled to said first resonator on a second layer of low-temperature-co fired-ceramic (LTCC);

a third resonator coupled to said second resonator and cross coupled to said first resonator;

an input transmission line connected to said first resonator;

an output transmission line connected with said third resonator; and

a voltage tunable variable capacitor in at least one of said resonators.

The 10-18-05 office action (OA) provides the combination of three patents to render obvious the present invention.

Peters (US '259):

Peters discloses a laminate dielectric filter that has an asymmetrical band pass response that is formed with a dielectric laminate structure that includes a first dielectric layer, a second dielectric layer and a third dielectric layer. A first resonator element and a second resonator element are interposed between the first and second dielectric layers and are arranged in a spaced apart relationship from one another. The first and second resonator elements each have a first end electrically connected to a circuit ground potential and a second end which is open circuited. Coupling structures are coupled to the first and second resonator elements to provide input/output ports for the filter. A third resonator element which has a first end electrically connected to a circuit ground potential and a second end which is open circuited is interposed between the second and third dielectric layers and is positioned to be disposed between the first and second resonators such that the first, second and third resonator elements are magnetically coupled to each other.

Ammar et al. (US '404):

Ammar discloses a millimeter wave filter for surface mount applications which includes a dielectric base plate having opposing surfaces. A ground plane layer is formed on a surface of the dielectric base plate. At least one low temperature co-fired ceramic layer is positioned over the ground plane layer and defines an outer filter surface. A plurality of coupled line millimeter wavelength resonators are formed as stripline or microstrip and positioned on the outer filter surface. Conductive vias extend through the at least one low temperature co-fired ceramic layer, ground plane and dielectric base plate and interconnect the radio frequency terminal contacts and coupled line resonator.

Liang et al. (US 6,492,883):

The Liang patent is commonly owned with the present invention and Dr. Liang was a co-employee with the inventors of the present invention and knows of the present inventors hard work and research and development to enable the present invention and the use of voltage tunable dielectric varactors in the LTCC based electronically tunable multilayer microstrip-stripline combline filter of the present invention.

Liang discloses a method for operating a duplexer including a first tunable bandpass filter, a second tunable bandpass filter and means for coupling the first bandpass filter and the second bandpass filter to an antenna. The method comprises the steps of tuning the first tunable bandpass filter to provide a passband corresponding to an assigned transmit frequency, and tuning the second tunable bandpass filter to provide a passband offset from an assigned receive frequency, when the duplexer is operated in a transmit mode. When the duplexer is operated in a receive mode, the first tunable bandpass filter is tuned to provide a passband offset from an assigned transmit frequency and the second tunable bandpass filter is tuned to provide a passband corresponding to the assigned receive frequency.

Further, the filters of Liang can include tunable dielectric varactors that can be rapidly tuned and are used to control the transmission characteristics of the filters. However, Liang

further states that "other dimension that strongly influences the design of the varactors is the length, L, of the gap as shown in FIG. 8. The length of the gap L can be adjusted by changing the length of the ends 126 and 128 of the electrodes. Variations in the length have a strong effect on the capacitance of the varactor. ."

103 Rejection Improper:

Applicant respectfully submits that it would not be obvious to combine the LTCC of Ammar, the multilayer filter of Peters and the voltage tunable dielectric varactors of Liang. First, Applicant respectfully submits that it would not be obvious to combine LTCC material while using voltage tunable dielectric material. Indeed, as an inventor who has worked with the inventors of the present invention, Dr. Liang realized the difficulties from a manufacturing standpoint of using LTCC with the voltage tunable dielectric varactors in a multilayer form of the present invention.

Applicant further respectfully submits that to use voltage tunable dielectric varactors in the multilayer filters is not a simple design task. As provided in the present invention, in one embodiment of the present invention, nine layers were provided. Further, in FIG. 7 the level of detail required to provide and integrate all components of the present invention are set forth. To wit:

700	RF choke resistors and the bottom metallization layer
705	Bottom metallized ground plane
710	Metal catch pad for connection to the DC bias port
715	Metal catch pad for connection to the DC bias port
720	Metal strip for the DC bias connection
725	Metal strip for the DC bias connection
730	Metal termination pad for the resistor
735	RF choke resistor
740	Metal termination pad for the resistor

745 Metal termination pad for the resistor
750 RF choke resistor
755 Metal termination pad for the resistor
760 RF choke resistor
765 Metal strip for the DC bias connection
770 Metal termination pad for the resistor
775 Metal termination pad for the resistor

As can be seen, much experimentation went into figuring out how to integrate voltage tunable dielectric capacitors on LTCC in a multiplayer form. For example, the need for DC blocking capacitors in order to provide variable voltage to the tunable varactors and where to place the tunable varactors is set forth on page 12, line 17 in detail as follows:

> The striplines go though apertures in the top ground plane (layer 6) to the top layer of the board. The microstrip portions of the resonators are folded back as shown in FIG 1. Therefore, the size of the filter is reduced by almost half. Microstrip portions of the resonators are used to mount the tuning components (dielectric varactors/MEM varactors/varactor diode) and the DC blocking capacitors. The combline resonators are shorted to both ends. Therefore, the DC blocking capacitors are necessary to apply voltage to the varactors for tuning. The DC biasing circuit is implemented by a short length of high impedance line and a high resistor.

As can be seen by the level of detail provided, it is not merely a matter of plugging voltage tunable varactors into Peters and using the LTCC tape of Ammar. If beneficial, an affidavit from Dr. Liang can be provided attesting to the difficulty from at least the combining voltage tunable dielectric capacitors into a multilayer filter point of view.

Thus, Applicant respectfully submits that with the above remarks and previous and current amendments, claim 1 and claims that depend therefrom are in condition for allowance.

Further, as the remaining independent claims contain the germane limitations set forth in claim 1, those claims and claims that depend therefrom are in condition for allowance as well.

CONCLUSION

Applicant thanks the Examiner for his time in examining the present application and respectfully submits that, in view of the foregoing amendments and remarks, the application is in clear condition for allowance. The Office is hereby authorized to charge any additional fees or credit any overpayments under 37 C.F.R. 1.16 or 1.17 to Deposit Account No. 502697. The Examiner is invited to contact the undersigned at 202-607-4607 to discuss any matter regarding this application.

Respectfully submitted,

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